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## Winning Investment: The Strategic Implications of the Growth of Sabermetrics in Japanese Baseball

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WINNING INVESTMENT: THE STRATEGIC IMPLICATIONS OF THE GROWTH OF  
SABERMETRICS IN JAPANESE BASEBALL

By

David Trent Pagliarini

Submitted in Partial Fulfillment  
of the Requirements for  
Graduation with Honors from the  
South Carolina Honors College

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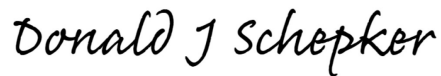
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## **Thesis Summary**

This thesis examines Japanese baseball and how the use of analytics and statistical research has been implemented into Nippon Professional Baseball (NPB), compared to its North American counterpart, Major League Baseball (MLB). Due to the large financial implications of the MLB, teams have fully adopted the use of advanced metrics to find competitive disparities and advantages in roster construction, game strategies, and player development. Because of the long history attached to baseball in Japan, many cultural differences have adapted the game and recently slowed the growth of sabermetrics. While the NPB is beginning to understand the competitive value that analytics provide, the involvement of large conglomerates in the ownership, operations, and governance of the league alter the considerations teams face when implementing a research-based strategy. Because of this ownership structure, the true value of statistical research is not entirely clear. How the teams, and corporations, choose to navigate this phenomenon within the game will not only reveal the purpose of the franchises' existence, but also will affect the competitiveness, value, success of Nippon Professional Baseball as the 2nd highest level of professional baseball in the world.

## **Introduction**

While historically considered “America’s National Pastime,” baseball has become an increasingly international game. Major League Baseball, considered the highest level of professional baseball in the world, had a player pool consisting of 28.4% foreign-born players on 2020 Opening Day rosters (“Opening Day Rosters,” 2020). This figure is higher than the National Basketball Association, a league that has aggressively invested in expanding its global presence, which has 23% of its players coming from abroad (Anderson, 2020). These players represent 20 different countries; the majority come from the Caribbean and Central America, where baseball is hugely popular, with others come from Asia and Europe (See Figures 1 & 2). These countries contain their own top-level professional leagues where many of these international players begin their career, namely the KBO League in Korea, the Dominican Professional Baseball League in the Dominican Republic, the Mexican League and Mexican Pacific League in Mexico, and Nippon Professional Baseball in Japan. From the highest level all the way to the bottom, baseball has become an inherently international game with talent coming from all over the globe. MLB teams have been forced to expand scouting footprints to capture this growth and to compete with other teams and leagues for talent.

Along with international growth, MLB revenues and salaries are consistently increasing, and the sport is more lucrative than ever. While the COVID-19 pandemic negatively affected revenues for sports leagues worldwide in 2020, with fans not being able to attend games, the MLB had a record \$10.7 billion in revenue in 2019. This was the 17th consecutive year that the league has seen record revenues, a trend that is expected to continue with the implementation of new television deals (Brown, 2019). As revenues increase, players demand higher compensation. Over the 40-year span from 1980 to 2020, the average MLB salary increased by 1,052%,

adjusted for inflation (Anderson, 2020). Players have also been able to negotiate increasingly larger contracts with multiple years of guaranteed money. Since 2015, there have been 6 free agent contracts or extensions worth over \$300 million, each with a span between 10 and 14 years (Langs, 2021). The last 20 years have forced teams to consider the wisdom of tying themselves down to giant, multi-year contracts, especially as players' health, talent, and ability over time continue to be factors. Further, teams must be able to supplement the expensive established talent with young and inexpensive players whose ability is often difficult to predict. As a result of these trends, teams have been forced to think differently about how they evaluate players, both in terms of deciding who to award a large contract and the areas in which they can find value in unproven players where other teams can't.

Major League teams have implemented this historically unorthodox thinking with the use of analytical tools and statistical analysis. Rather than basketball or soccer where players move freely within a playing field with a set amount of time on the clock, baseball progresses based on various events or outcomes. Players are delegated to a generally "fixed" position and each "play" must be initiated with one specific player, the pitcher, throwing a pitch to one specific hitter. The outcome-based nature of the game allows statistics to be more easily measured or tracked relative to other sports. Additionally, baseball seasons are considerably longer than other sports with each MLB team playing 162 games a year, providing very large amounts of available data. Teams can analyze league-wide trends, create in-game strategic decision-making tools, project overall team success, or develop the skillset of individual players, all using math and statistical analysis. For example, the Houston Astros traded for Gerrit Cole, a statistically average pitcher from the Pittsburgh Pirates, before the 2018 season. The Astros deduced from his data that he would improve his pitching by increasing the spin rate on his fastball, throwing more pitches up

in the strike-zone, and decreasing the overall number of fastballs he threw (Sawchik, 2019). After implementing these minute changes in his pitching style, Cole established himself as one of the league's best and most dominant starting pitchers. In 2019, he went on to lead the American League in earned run average and number of strikeouts and guide the team to the World Series as the #1 pitcher in their rotation. That season, he finished second in voting for the Cy Young award, an honor given to the best pitcher in each league. After the 2019 season, he signed the largest free agent contract for a pitcher in history with the New York Yankees, a deal worth \$324 million over nine years (Hoch, 2019). The large amount of available data, combined with various levels and types of analysis, create infinite opportunities for baseball teams to find market inefficiencies and field the most competitive, cost efficient teams.

In Japan, baseball is the most popular sport with 42.8% of citizens claiming it as their favorite (Chuo Research Inc., 2018). Japan's national team, Samurai Japan, is currently ranked number one in the World Baseball and Softball Confederation Rankings and won the 2019 Premier12 tournament against the other international teams ranked in the top 12. The country's top league, Nippon Professional Baseball, had an estimated total attendance of 26,536,962 in 2019 ("WBSC Rankings," 2020; "観客動員数(2019年)," 2021). This was second in the world only to Major League Baseball in the U.S., which has almost three times as many teams and longer seasons. The NPB is widely considered by scouts as "AAAA," meaning the level of play is not as high as what you would see in a typical MLB game, but is higher than the top minor league in the U.S. with a "AAA" rating. The league is popular, and the level of play is high, however analytics have not yet been widely accepted in Japan as they have in the U.S., with the MLB having shifted to analytics-based scouting and strategy almost 20 years ago. While some NPB teams have made significant steps towards implementing analytical research in their



organizations, various cultural differences have stood in the way. This thesis seeks to explore the reasons why Japanese teams have been slow to adapt, how analytics have been embraced thus far, and important factors that teams must consider as the Japanese league's use of analytical strategies grows.

### **Baseball in Japan**

Baseball has been a part of Japanese culture for almost 150 years. The game was first brought to Japan during the Meiji Era in 1873 by English and American History teacher Horace Wilson. While teaching at Kaisei-ko, the modern-day University of Tokyo, he taught his students the rules and fundamentals of baseball to give them more physical activity. Competitive games were soon organized between classmates and teachers and the sport began to gain popularity in Tokyo. High school and college teams were formed around the Tokyo area, with the first professional team being formed in 1883 by a railway engineer named Hiroshi Hiraoka (Whiting, 1989).

In 1898, high schools and universities around the country began to quickly adopt the game and create teams after the Ichiko School beat a team consisting entirely of Americans with a score of 29 to 4 (Whiting, 1989). With regular competition, amateur baseball gained an enormous following, entrenching itself in Japanese culture at the start of the 20th century. Japan's university students that adopted baseball enjoyed the game and went on to become government and community leaders. This gave baseball popularity among the upper class and provided a foundation for the game to be implemented professionally and grow (Ikei, 2000).

Although many independent clubs were taking shape in the early 20th century, no formal professional league existed. However, in 1934, the Yomiuri Shimbun, a popular national

newspaper, sponsored a team of Japanese “all-stars” to compete against a visiting American all-star team – that included Babe Ruth – in hopes of generating an increase in newspaper circulation (Whiting, 1989). The visit proved widely successful, and the Yomiuri-sponsored team remained together to form the modern-day Yomiuri Giants, who, based in Tokyo, are Japan’s most popular team (Chuo Research Inc, 2018). Six other teams were created by 1936, thereby establishing the Japanese Baseball League as the first professional baseball league in Japan. The league continued to develop successfully until World War II. Many players left to fight in the war, eventually causing the league to stop play for a year due to a lack of players.

Following the war, the post-war economic boom allowed the league to grow and become what it is today. In 1950, the Japanese Baseball League was reorganized into the present-day “Nippon Professional Baseball” league, with major corporations heavily investing in professional teams. The new wide-spread use of the television allowed the league to take off and gain a following nationwide (Whiting, 1989). Since the reorganization, NPB has produced many talented players, some having successfully transferred to Major League Baseball in pursuit of higher salary, wider fame, and heightened baseball performance. These players, like Ichiro Suzuki, Hideki Matsui, and Hideo Nomo, have gone on to be modern-day Japanese cultural icons.

The nature of the game of baseball is also very in line with Japanese culture and character, providing reason as to why the game caught on and has remained a staple of Japanese culture since its introduction. Baseball has a slow pace when compared with other American sports. There is no predetermined clock or length of time, only a fixed number of innings – nine – that only increases in the event of a tie. The progression of the game is largely dependent on the rate in which the pitcher throws the ball to home plate and that in which a team accumulates

players being called “out.” Therefore, the game moves at a pace that contains small breaks between pitches, situations, and innings. The Japanese people are generally considered to have a reactive culture, one characterized by attentive listeners that absorb information and take their time to arrive at a conclusion or give a response. Robert Whiting, a writer and journalist who has covered baseball in Japan for over 40 years, said, “The Japanese are extremely careful. They like to fully discuss and analyze a problem before reaching a decision” (Whiting, 1989). The time between pitches and innings allows for the discussion and strategic analysis of situations in order to make good, rational decisions. The Japanese fans appreciate this aspect of the game and consider it to be an important and exciting part. The game also falls in line with the importance of the group and individual challenges or tests in Japanese culture. “When their teams clashed, the excitement was over not only the battle between two teams, but also over the one-on-one battle between individuals. For the fans, it was breathtaking, like watching a fight-to-the-death sword duel in a samurai movie” (Ikei, 2000). These cultural values changed the game over time, giving the country its own unique version and style of baseball.

Today, Nippon Professional Baseball is still Japan’s top professional baseball league, with over \$1.3 billion in revenue (“観客動員数(2019 年),” 2021). The league contains 12 teams spread across 11 different prefectures, spanning the entire country with the Hokkaido Nippon-Ham Fighters located in the northern Sapporo and the Fukuoka Softbank Hawks located in the southern Fukuoka (See Figure 3). The 12 teams are divided into two leagues, the Central and the Pacific, with six teams in each (See Figure 4). Similar to Major League Baseball, one league, the Pacific, uses the designated hitter (where another player can hit in place of one of the players in the field, typically the pitcher) while the other, the Central, does not. NPB teams play 143 regular season games, 19 fewer than MLB, but the season still occurs over the same time period from

April through September, with the postseason taking place in October. At the conclusion of the regular season the top 3 teams from each league by record, compete in the Climax Series playoff tournament. This tournament determines the two league champions that will meet in the Japan Series, similar to the World Series of MLB, which determines the overall champion of the NPB league. However, the NPB playoffs are different from the MLB in that the first-place finishers from each league at the end of the regular season receive a first-round bye as well as a one-game advantage in the second round (Ikei, 2000).

Both leagues also contain similar systems for player development and acquisition. Professional teams hold an annual draft where they can fairly select and sign players from both the high school and college level. These players can then be added directly to the team to compete in the upcoming season or be placed in the minor leagues for further development. Should the minor league players prove their ability to executives, they can then be called up to join the top team at a later date.

While the NPB is the top professional league in Japan, the high school level competition that provided the foundation for the growth of the sport and formation of a professional league still remains prominent. Every year, two major high school tournaments receive national attention and media coverage. The tournaments, known as “Koshien,” consist of local teams from various prefectures, demonstrating the importance of baseball to the country at a fundamental, grassroots level. People enjoy the narrative of their local team progressing through each stage of the tournament and making a name for themselves on the national stage (Ikei, 2000). Baseball in the U.S. lacks this localized element of the game because it gained popularity through professional leagues, not amateur ones.

While MLB games will be played until a winner is decided, regardless of the time or number of innings played, the NPB allows for ties games. In NPB, regular season games that are tied after 12 innings, or those that reach a 3 and ½ hour time limit, end with both teams accepting a draw. This difference is representative of how the game was adapted for Japanese taste as well as innate cultural differences between the two countries. In a piece about American sports leagues moving away from the possibility of ties, Frank Deford from Sports Illustrated wrote, “A tie has no place in sports. It's like not finding out who is the ‘who’ in whodunit,” reflecting a widely accepted sentiment among Americans that someone must be named a winner. Some former Americans that played in Japan attribute the aspect of ties to the cultural custom of “saving face,” arguing that Japanese players are content with ties because no one will go home a loser (Whiting, 1989). However, Wayne Graczyk of the Japan Times offers a more pragmatic reason, saying, “Because Japanese teams do not have their own private transportation, and fans need to get home while the trains are still running, night games cannot go into the wee hours of the following morning as they sometimes do in the major leagues.” Either way, the collectivist ideas important in ensuring the game is practical for each party involved represent the influence of each country’s culture on their version of baseball.

### **The Japanese Posting System**

A critical component of the relationship between the MLB and NPB is the posting system, which provides a framework under which NPB players that have not yet reached free agency can move to the MLB and sign a new contract. Historically, Japanese players have had little labor protection and working rights relative to their MLB counterparts, aligning with Japan’s historically tough work culture. For example, the MLB and the Major League Baseball

Players' Association (MLBPA) entered the first ever collective bargaining agreement (CBA), in any sports league, in 1968. This gave the players more leverage in contract negotiations and the power was shared between both owners and players, unlike before (Snyder, 2009). The NPB has no such agreement and a player's salary is largely left at the mercy of ownership. The concept of free agency, a player's ability to negotiate a contract with any team, was not implemented into Japanese baseball until 1993, 18 years after the MLB adopted it. Even then, MLB players reach free agency after six years of major league service time, starting from the date of their major league debut. NPB players don't reach free agency until they accumulate nine years of service time. ("Free Agency," n.d.; "International Free Agency—Asia (Professional)," n.d.). Prior to 1993, players were expected to play for their team "for life," a concept that comes from Japanese corporate culture in which graduates are hired by large firms directly out of college with the understanding they will be given lifetime job security in return for absolute commitment to the company. Although this idea is beginning to be phased out in Japan, the underlying authority employers have over their employees remains prevalent, even in baseball (Murakami, 2019).

Until the posting system was implemented in 1998, Japanese players had no freedom to pursue greater compensation, competition, and exposure by moving to the MLB because of rules related to contractual obligations in the U.S.-Japan Player Contract Agreement. Others had tried, but none found success until Hideo Nomo moved to the Los Angeles Dodgers prior to the 1995 season. Nomo had a growing distaste for the Japanese style of practices that didn't promote rest and recovery for players. His manager, while playing for the Kintetsu Buffaloes, Keiishi Suzuki, said, "The best way to cure a sore arm is to throw more" (Whiting, 2010). Nomo had previously won the Pacific League MVP award and was confident in his ability to play in the MLB after comparing himself to visiting MLB All-Star teams, so he expressed to his agent, Don Nomura,

that he wanted to move. Nomura then found a loophole in the Japanese Uniform Players Contract called the "voluntary retirement" clause, which ruled that a player who retired and wanted to make a comeback had to play for his former team as long as he stayed in Japan. Under this clause, Nomo could voluntarily retire from the NPB and then be free to negotiate and sign a contract with an MLB team (Whiting, 2010). So, Nomo exercised this loophole to retire from the NPB and sign with the Dodgers prior to the 1995 season, later going on to win MLB Rookie of the Year ("Hideo Nomo Signs Three-Year Contract With Dodgers," 1996).

After two similar instances of players escaping to the MLB, the commissioners of both leagues agreed to establish a posting system, allowing players to move to the MLB and the Japanese teams to receive compensation in the form of a posting fee. The Japanese teams argued for this compensation in order to mitigate the loss of their most talented – and generally most marketable – players to MLB teams with much larger payrolls and financial resources. While the agreement has been modified over time, early iterations involved a bidding process in which teams would blindly bid on players that were posted, without any knowledge of other team's bids and their amount. This would sometimes result in posting fees greater than \$50 million (See Figure 5). To avoid those high posting fees, an agreement negotiated prior to the 2013-2014 posting window included a maximum fee of \$20 million. This was determined by the NPB team to which the player had contractual rights and gave the player the opportunity to negotiate with any MLB team willing to pay the fee (Corcoran, 2013). Under the current agreement, in effect since the end of the 2018 MLB and NPB seasons, players can be posted during a window from November 1<sup>st</sup> to December 5<sup>th</sup>. All 30 MLB teams then have the right to negotiate with the posted player for 30 days after the initial posting date. If an agreement is not reached, the player must return to his Japanese club and cannot be posted again until the next year's posting

window. If the player and an MLB team do reach an agreement, the NPB team will receive a posting fee dependent on the amount of guaranteed money that player signs for. NPB teams will receive 20% of the first \$25 million, 17.5% of the next \$25 million, and 15% of any amount in excess of \$50 million. For players that end up signing minor league contracts, the fee is 25% regardless of the value (“Japanese Posting System,” n.d.).

This new system has significantly benefited both MLB teams and Japanese players seeking new opportunities. The players have much more freedom in being able to negotiate with any team instead of being restricted to joining whichever team placed the highest bid. By calculating the fee as a percentage of the contract, rather than a flat fee, the cost of acquiring a player is directly tied to his perceived value by the MLB team while the risk is lowered if that player doesn’t perform as expected. For example, the Texas Rangers paid the Hokkaido Nippon-Ham Fighters a posting fee of \$51,703,411 for pitcher Yu Darvish in 2011, when the system gave negotiation rights to the highest bidder (See Figure 6). The Rangers then signed him to six-year contract worth \$60 million, meaning the total cost of Darvish for six years of play amounted to over \$111 million. In 2018, after the current system came into effect, the Seattle Mariners paid the Saitama Seibu Lions \$10,275,000 for pitcher Yusei Kikuchi after signing him to a four-year, \$56 million deal. Although the size of the contracts was similar in terms of guaranteed money, the posting fee for Kikuchi was roughly 20% of Darvish’s. When evaluating the cost of the posting fee as a percentage of the total cost the team accrues by acquiring and signing a Japanese player, this measure has seen a decreasing trend as a result of the new agreement (See Figure 7). Under this system, MLB teams don’t need to risk as much in the sunk cost of a posting fee, and the incentive is greater than ever to pursue Japanese talent.



### **Growth of Sabermetrics in the United States**

In the early 2000s, the Oakland Athletics became the first MLB team to widely, and publicly, implement statistical analysis into their baseball strategy and the construction of its roster, a concept known today as “sabermetrics.” As a team that had a significantly lower budget than others like the New York Yankees or Boston Red Sox, they were forced to compete with fewer resources and extract the most value they could out of their payroll. They did this using statistical theories developed by Bill James. James, an average fan who spent his night shifts as a security guard, wrote a series of abstracts that posed questions about baseball strategy and attempted to answer them with objective data as opposed to subjective. James’ ideas and reasoning directly contradicted the methods major league clubs used to evaluate players and formulate strategy, subjective methods based on feeling, experience, and knowledge of the game. James published his first abstract in 1977 and continued to publish other statistical works through the 80s and 90s to little success. However, the A’s embraced his ideas roughly 25 years after his first publication and implemented a strategy of signing players they believed were undervalued to compete with the wealthier teams. Despite widespread ridicule from other scouts and teams, the A’s qualified for the 2002 postseason after losing their 3 core players from previous seasons to free agency. This qualification proved that success could be found using a statistics-based strategy (Lewis, 2004). Bill James was later hired by the Boston Red Sox in 2003, who went on to win the World Series in 2004 by constructing a bullpen of undervalued relief pitchers and placing importance on the on-base percentage statistic, both suggestions from James (Goldman, 2005).

In the 15-20 years since the A’s Success, every major league team has implemented the use of analytics into its operations in some form or another, and those that have fully embraced it

have generally had more consistent success than others. The Houston Astros, the team that developed Gerrit Cole into a pitcher the Yankees valued at \$324 million as described earlier, have become known as one of the most developed teams in statistical analysis. In 2011, the Astros hired Jeff Lunhow as their new general manager. Lunhow was an executive responsible for building the St. Louis Cardinals analytics department that helped them win the World Series in 2011 and reach the playoffs each of the following four years. With the Astros, Lunhow spent time developing the team's analytics department and convincing the staff, scouts, coaches, and players to buy in. Irving Wladawsky from the Wall Street Journal described the process after interviewing Lunhow, "First, he had to get the player-acquisition decision makers to leverage data to help them make better decisions. That was the relatively easier part. Much harder was convincing the coaches and players across the Astros' organization, including their extensive minor leagues and player development system, to use all the available information in their every-day decisions, such as game-day lineups and defensive configurations. That took three to four years of really hard work." The process of overcoming deep-rooted strategic thinking was not a rapid one, but eventually the Astros became one of the most forward-thinking organizations in the MLB. From 2017 to 2020, the Astros reached four American League Championship Series, won two of them to reach the World Series twice, and won the World Series in 2017. As of February 2021, they have 44 employees in their baseball operations department alone, with 18 having the key word "R&D," "analyst," "analysis," "developer," "research," "systems," or "information" in their job title ("Astros Front Office Directory," n.d.).

While the Astros are one of the best teams at developing players through the use of analytics, as they did with Cole, they are still a large-market team that has considerable resources and the ability to sign expensive free-agents. Conversely, the Tampa Bay Rays have been noted

as one of the best teams at finding value in unknown players; they have to in order to remain competitive as a small-market team. Because the Rays cannot afford to be very active in the free agent market like other teams with large payrolls, they rely on maintaining a talent pool full of young, inexpensive players whose ability is identified through the use of analytics (Shaikin, 2020). Once their prospects prove themselves, they either leave for teams that can offer higher compensation, or the Rays trade them for other young prospects that can replenish their talent pool, much to the dismay of their few veteran players like Blake Snell (Bumbaca, 2019). This strategy has brought the Rays success over the past few seasons, including a World Series appearance in 2020, despite having the third lowest payroll in the league (Lee & Schoenfield, 2020).

The Los Angeles Dodgers are another example of an organization that has found success after investing heavily in analytics. While they do have the ability to maintain one of the highest payrolls in the MLB and spend large sums of money on top-level talent, like right fielder Mookie Betts, they also have one of the largest departments dedicated to analytics in the league (Verducci, 2020; Paine, 2020). According to their front office directory, they have 66 employees in their baseball operations department, 22 of which have the same key words related to analytics staff used for the Astros' front office in their job title ("Front Office Directory, n.d.). One unique caveat about the Dodgers is their ability to sign expensive free agents like the Astros, while consistently replenishing their young talent pool like the Rays. They routinely acquire a large number of young players to develop them, in hopes of a few eventually becoming top players that can be brought up to the Major League level. Analytics are not only used for the Dodgers at the top level, but throughout their entire farm system of minor league teams for development. Neil Paine from statistical journal, FiveThirtyEight, stated "the beauty of these Dodgers is that

they don't exist in that continuum between contending and rebuilding. They rebuild and they contend, all at once." The Dodgers are using analytics to properly assign value to free agents, develop players to be more competitive, and find younger, undervalued players all at once. This core competency of the organization has permitted them to be a sustained, competitive powerhouse in the National League, winning eight straight NL West Division titles, three of the last four National League Championship Series, and the most recent World Series in 2020.

Although the Red Sox proved that teams could win a World Series with the use of analytical methods in 2004, it took roughly another 15 years for teams to fully adapt and realize success as a result. For perspective, the New York Mets were one of the last teams to invest significantly in analytics. Kyle Newman, a writer for ESNY who is both a Mets fan and statistical writer, wrote in October of 2020, "Advanced analytics never took off in Queens. The Wilpons were vehemently against the idea of numbers controlling a baseball team. Despite calls from the likes of Omar Minaya, Sandy Alderson, and Brodie Van Wagenen, they refused to expand. As a result, the Mets now have the second smallest analytics department in MLB." However, this is beginning to change with new owner Steve Cohen, signified by four new jobs posted on the Mets' career and job openings page in February of 2021 that are analytical roles.

This 15-year time frame was partially due to ownership and personnel within teams needing to accept the change and learn how to properly use the information to make better decisions, but technology also played a role. What the A's were doing in the early 2000s largely used outcome-based, box score data, like on-base percentage, to project overall trends over the course of the season. Now that data-tracking systems like Statcast and TrackMan are widely available, teams have much greater access to performance data. Lunhow of the Astros also said, "Today, it's completely different. We now have so much technology around the ballpark and

information about the trajectory of the ball, the physics of the bat swing, the physics and the biomechanics of the pitcher's delivery - so many components now that advanced sciences have worked into our game. It's, quite frankly, overwhelming in terms of the amount of information that we have access to and intimidating to figure out how to analyze all that information, work through it, and come up with the takeaways that will allow you to continue to do what we tried to do back in 2003, which is to make better predictions about what players are going to do in the future on the field" (Wladawsky, 2018). Information from Statcast, a system that reports measurements from on-field action including exit velocity, launch angle, spin rate, and catch probability, to name a few, was not available in every major league ballpark until 2015 ("Statcast," n.d.; Chen, 2016). Now that more data than ever is widely available to every team, every MLB club in 2021 has some form of an analytics department dedicated to statistical research. Those that have the highest capability to extract meaning from it and find market inefficiencies will likely see the most success.

### **Sabermetrics Come to Japan**

The acceptance of analytics in Japan has followed a similar pattern to that in the MLB. Robert Whiting describes Japanese baseball as "conservative" and "orthodox," noting that "It takes a while for new wrinkles from MLB to catch on in Japan." Despite the growth in the U.S., the value of sabermetrics wasn't quickly accepted in Japan. A man named Yusuke Okada, however, became fascinated in the application of statistics to baseball and decided to push for more sabermetric analysis of the Japanese game, earning the moniker, the "Bill James of Japan." Okada, like James, was considered an outsider to the game; his first job out of school was at a call center. After seeing the success of Hideo Nomo in the MLB, he became interested in

American baseball and began reading statistical literature, including works published by James. Books about sabermetrics, specifically, stood out because the math made it easier for him to understand without any knowledge of English. Okada got his first job in baseball in the early 2000s working for Nippon TV, in a role charged with creating statistical graphics for NPB broadcasts. However, there wasn't much data available, and he often had to track metrics himself. By 2006, he left Nippon TV to work for Data Stadium, a company that tracked and sold pitch and batted ball data to NPB teams and media companies. However, those in leadership at the company were not interested in expanding their service into one that offered statistical analysis and research along with the data. Okada said, "I tried to explain the significance of advanced research to my bosses at Data Stadium as well as people working for NPB clubs, but they rarely listened to me. For about 10 years from 2002, no one tried to understand, or even cared about sabermetrics. ... I was rejected right away." Unable to change Data Stadium, Okada moved on and decided to start his own company in 2011, Deltagraphs. Able to collect the data he wanted, Okada hoped to prove the value of sabermetrics to NPB teams (Lindbergh, 2017b).

Deltagraphs is a website comparable to Fangraphs in the U.S., which is a baseball database, journal for statistical research and news articles, and general hub for those interested in sabermetrics. The site's initial goal was to heighten awareness of analytics in Japan and grow the community of sabermetric researchers. What is different about Deltagraphs, however, is that the company also provides a service in the form of statistical consulting. They provide research and strategic recommendations to NPB teams as they only have one or two employees dedicated to research, if any at all. This began in 2012 when the Tohoku Rakuten Golden Eagles asked him to help create a "strategy and analytics" department within the organization. The team received a new team president, who didn't have a background in baseball and was receptive to Okada's

ideas. Okada said, describing meetings during the 2013 season, “It became clear that the manager agreed with my thoughts on the team’s weakness. The team climbed up the standings as he fixed the problem.” The team went on to win the Japan Series later that year and solidified the new analytics department as a permanent aspect of the team (Lindbergh, 2017b). Even with the success of the 2013 Golden Eagles, it took Okada a few years to convince NPB teams of his value. In an October 2019 interview with Yoshiki Masaki, an employee at Deltagraphs, he noted that roughly half of NPB’s 12 teams use Deltagraphs’ consulting services, six years after Tohoku Rakuten’s championship (Y. Masaki, personal communication, October 31, 2019).

### **Japanese Culture and Sabermetric Growth**

In the same way that it was difficult for coaches in the U.S. to understand the value of implementing statistical research into their gameday decisions, Okada faced difficulty in persuading coaches and executives to use sabermetrics. He said, “When I was set to have a meeting with an NPB club, their baseball operations person, who was a former player, yelled at me. He said, ‘What are you doing here? You didn’t play at the professional level. Go home!’” (Lindbergh, 2017b). The coach’s reaction stemmed from a long-standing facet of Japanese culture: the “Senpai-Kouhai” relationship. “Senpai” translates to “senior” while “Kouhai” translates to “junior,” although the Japanese definition of this relationship is based on when a person, either earlier or later, joins an organization relative to the other. “Both Senpai and Kouhai are relative terms since both are based on comparisons of status, skills, age, and time of entrance into a group. In other words, Senpai exists only when there are Kouhai, and Kouhai exists only when there are Senpai” (Sano, 2014). For someone not employed directly by the team, especially one who never played or coached baseball, to suggest that a coach with decades

of baseball experience should do something differently, was in direct violation of this cultural custom. The Kouhai is supposed to follow and learn at all times, never questioning or doubting the Senpai's ability. Those with analyst roles in an organization are typically younger with a degree related to programming or computing. In Japan, these younger people would be the last to offer any advice or suggestions to someone in a position of authority with baseball experience. "According to Guttridge, NPB teams still eschew infield shifts not because they aren't aware that the tactic exists, but because shifting would imply that previous managers who didn't shift were wrong not to have done so" (Lindbergh, 2017b). Despite the existence of a tactical advantage, the cultural customs prevail and are placed above competitiveness.

This lack of competitive drive is also apparent in the ownership structure of NPB clubs. For comparison, MLB teams are owned by individual owners or groups of owners known as a "consortium." The teams operate as their own entities, seeking to make a profit by selling tickets, concessions, and merchandise, while also attempting to maximize their local television contracts. These contracts represent how much a television network is willing to pay for the rights to broadcast a team's games. These contracts range from roughly \$20 million a year all the way to \$250 million a year and represent a significant portion of a team's revenue stream, roughly 60% (Passan, 2020). Both the size of the TV contracts and the number of tickets sold are relatively dependent on that team's success and level and competitiveness. The more a team wins, the higher their revenue will be. This makes the primary objective clear for MLB teams: construct the best possible roster, within financial limitations, that gives the club the best chance of winning.

This picture isn't as clear in NPB as the clubs are owned by corporations rather than independent owners. The teams operate as a subsidiary of that company, and even include the



parent company's name in their own (See Figure 8). This is why the Giants are the "Yomiuri Giants" rather than the "Tokyo Giants," and why the Fukuoka SoftBank Hawks have an "SB" insignia on their hat rather than an "F" or "H." The corporations run the clubs for the sole purpose of marketing their brand. "Owners tend to put the clubs in the promotion department and recognize that the main purpose of possession of the team is to promote the brand of products, outstanding image of enterprise, and good public relations to the mass etc." (Lee et al., 2010). For these corporations, primetime TV advertising on a regular basis in Japan is far more costly than running a baseball team that markets the company itself. Further, those in the top positions of the front office running the club typically don't have a baseball background and are simply executives placed there from the parent company. "Whereas MLB general managers lie awake at night thinking of ways to create a better team and increase profits, their Japanese counterparts toss and turn at night scheming for transfers back to the parent company" (Whiting, 2007). This makes it increasingly difficult to prove the value of analytics to ownership, even more so than coaches given that they don't prioritize winning.

The owners, to their credit, don't have much incentive to invest in analytics as most NPB teams don't make a profit. "There are two teams that have historically done well. The Giants and Tigers both draw 3 million fans a year and each are estimated to take in somewhere in the neighborhood of 20 billion yen annually, the bulk of that in ticket sales and TV rights" (Whiting, 2007). Even then, those profits are directly remitted back to the parent company. The teams themselves can't reap the rewards from their own success and invest it back into the club. The rest of the teams don't even have earnings to remit, and their parent companies regularly provide subsidies to keep them in operation. Much of their struggle is attributed to the significantly low television deals relative to the MLB. "Whereas the Giants are able to sell their TV rights at a

robust 100 million yen per game (and the Tigers around 50 million yen), the Dragons have to settle for a rather low 10 million yen for most of their home games, Nippon Ham 3.8 million yen and the Marines a piddling 150,000 yen” (Whiting, 2007). With TV revenues so low for most teams, executives don’t have reason to spend resources on competitiveness, especially since the teams will be bailed out by their parent companies regardless. The clubs serve their intended purpose as marketing tools and, as long as the parent company prioritizes that strategy, this lack of competitive spirit will not change, and investing in sabermetrics will not be a priority.

### **Japanese Analytics Today**

Despite these barriers, the use of analytics in Japanese baseball has grown since Okada got his foot in the door with the Tohoku Rakuten Golden Eagles. This growth can be represented by how many teams have a TrackMan radar system in their stadium. Though they might not be able to extract value from the data immediately, the tracking of the data itself indicates that they are moving in that direction. On TrackMan Baseball’s website, they claim that their system is used by the “majority of teams in Japan.” Teams do not directly publicize whether or not they use the system, so an exact number was determined based off of images uploaded to Google by individual contributors (See Figures 9 through 9I). The TrackMan system resembling a black box can be seen hanging above the stands behind home plate in 9 of the 12 NPB teams’ stadiums as of January 2021. These systems appear to have been implemented gradually from 2016 through 2019, though the exact time frame of this is not certain as pictures of the specific area needed for examination were not available for every month of every year. The fact that 75% of the league now has access to batted ball data indicates that teams are beginning to transition to the use of sabermetrics for their strategy.

One team, the Fukuoka SoftBank Hawks, has been noted as the team that has been most receptive and progressive in the analytical movement by Yoshi Masaki from Deltagraphs (Y. Masaki, personal communication, October 31, 2019). The Hawks are a client of Deltagraphs, were one of the first few teams to install TrackMan, and have won the Japan Series in six out of the last seven years, including four straight from 2017 through 2020. While other teams have implemented TrackMan, the Hawks have likely benefitted the most as they can leverage core competencies from their parent company related to information technology. SoftBank is multinational conglomerate with subsidiaries involved in telecommunications, financial services, and technology, and was the 66<sup>th</sup> largest company in the world according to the 2020 Forbes 2000 (“Corporate History,” 2020; Murphy et al., 2020). They are more likely to have existing employees capable of quantitative analysis than teams like the Yomiuri Giants or Chunichi Dragons, both of which are owned by large newspapers, the Yomiuri Shimbun and Chunichi Shimbun, respectively (See Figure 8). While the team does have considerable resources and the ability to sign expensive players, it is also one of the few NPB teams with a 3<sup>rd</sup> farm team. Fukuoka has significantly invested in expanding its developmental system, similar to the Dodgers, in hopes of finding inexpensive talent that will turn into valuable NPB players. In 2016, the team spent between ¥5 and ¥6 billion yen, roughly \$60 million, on a brand-new farm system base in Chikugo, Japan (Nagatsuka, 2018). According to an image from 2016 uploaded to Google, the new main stadium even has TrackMan installed, indicating that the Hawks are not just using sabermetrics to evaluate their NPB squad, but also to more effectively develop their younger players. The head of Fukuoka’s Baseball Operations Unit, Sugihiko Mikasa, explained outright that the club’s strategy is to accumulate as many young players as possible and have them compete against one another for promotion, rather than relying on more traditional scouting

methods that choose which players to develop subjectively. Mikasa said “If one player out of 10 gets promoted to the top team and does well, we can say our development is successful,” and “I came from a non-baseball background, but I’ve heard scouts say, ‘this player is good, this player isn’t, and things like that. But to me, there were just slight differences between those players. So, we want to have many players and let them compete with each other” (Nagatsuka, 2018). This system creates a pool of players that consistently produces talent capable of competing at the top level, setting the club up for long-term success.

The SoftBank Hawks are embracing a strategy and way of thinking more similar to a modern MLB team, rather than a traditional NPB one, and it is appearing to pay off. The team had the third largest attendance in NPB in 2017, trailing only the Yomiuri Giants and Hanshin Tigers, the only two profitable teams. The farm teams also drew 135,000 fans in 2017, almost seven times as many two years prior. With their success, more fans are buying tickets and the Hawks are bringing in more and more revenue. Although official figures are not publicly available, Mikasa indicated the yearly turnover in 2017 was greater than ¥30 billion for the first time ever (Nagatsuka, 2018). This growth can be expected to continue as the Hawks have created a sustainable competitive advantage in their development and analytical approach, setting themselves up to be regularly competitive in the future. If other clubs want to compete, they will have to continue to invest in research and development and embrace the analytical movement as the Hawks have. Otherwise, they will be left behind and remain uncompetitive.

### **Considerations as Sabermetrics Grow in Nippon Professional Baseball**

As more Japanese teams adopt analytics-based strategy, the methods they use will have to be adopted for the Japanese game. Okada from Deltagraphs said, “Basically, we replicate the

research done by American analysts and see if the same trend comes up or there's a different outcome. Since we are behind stateside analysis, we have to do it that way" (Lindbergh, 2017b). While many trends from American baseball, like placing high value on batted ball exit speed for instance, can be valued similarly in Japan, other trends and models won't be directly applicable. For example, many MLB teams use models on a macro, season long, level to project how many wins they expect to need to make the playoffs, as well as how many runs they'll need to score to reach that number of wins. This analysis would have to be adapted to factor in the possibility of a tie in the NPB. Similar models might also not be as accurate or reliable considering the NPB plays fewer games in a season, resulting in lower amounts of available data. An accurate model like this, however, would be more valuable in the NPB considering the possibility of a first-round bye and one-game advantage gained in the Climax Series if a team finishes with the best regular season record. Adopting strategies used in the MLB is a good steppingstone as teams first begin to implement analytics and learn the fundamentals of sabermetric approaches, however they will eventually have to find their own inefficiencies, specific to the Japanese style of play, that the other teams can't easily replicate or copy.

One of the most notable plays in Japanese baseball that could change is the sacrifice bunt. The bunt is widely perceived as the epitome of self-sacrifice in the game of baseball – giving up the individual chance of success in order to provide a scoring opportunity for the team. Analytics show that the bunt rarely, if at all, provides the best statistical advantage, and the MLB's best power hitters often play entire seasons without attempting a bunt. However, this trend has not yet caught on in Japan as the importance of the sacrifice of the individual for team success is deeply embedded in the culture. In 2017, NPB teams bunted 4.2 times the rate in which MLB teams bunted (Lindbergh, 2017b). Whether or not teams overcome this cultural characteristic and the

Japanese game sees a decrease in sacrifice bunts is yet to be seen, but can be expected as more teams adhere to sabermetric advice.

Even then, moving away from the sacrifice bunt might not be in the interest of teams given the abilities of the players. One player from the Hokkaido Nippon-Ham Fighters named Takuya Nakashima is viewed as a statistical embodiment of Japanese baseball. He hasn't hit a single home run, has a ground ball rate of 74.4%, and has a pull-rate of 16.2%. Most interesting is that he led the league in sacrifices with 62, while the MLB leader the same year had 11. These statistics are indicative of his strategy as a contact player that relies on his speed and putting the ball in play, in any part of the field, hoping to simply get on base and give his team a chance to score. He also led the league in foul balls, often having eight to ten-pitch at bats where he wears down the pitcher and extends the game. A YouTube video documented a 12-pitch at bat in which Nakashima fought off pitch after pitch and prolonged the at-bat, while the fans' cheers and excitement built throughout (See Figure 11). Despite managing a walk, the crowd roared as if he had just hit an extra base hit. His other highlight videos are entirely made up of great defensive plays, rather than other hitting highlights of home runs and extra base hits that are common for the MLB's best players. Nakashima is "one of the most popular players on the team" and was even offered a roster spot on the Samurai Japan national team for the World Baseball Classic (Lindbergh, 2017a).

If the NPB follows the MLB trend and decides to employ the sacrifice bunt less frequently, the aesthetics of the game could be significantly affected, and it would have the potential to be displeasing to the fans. For example, analytics showed that pitchers could be most effective if brought in the game to face 1 specific hitter. The MLB game then experienced an increased number of pitching substitutions, much to the fans' dismay as it slowed the game

down. To combat this, the MLB implemented a rule in 2020 stipulating that pitchers must face a minimum of 3 batters in order to speed the game up (Petriello, 2019). NPB league officials will have to be prepared to implement rules, dependent on how changes in competitive strategy particular to the Japanese game affect viewing aesthetics, in order to keep the game appealing to a Japanese fan base. Conversely, the league has a whole could disregard this analytic strategy and continue to value players like Nakashima that are a better fit within the Japanese game. The statistical evidence from NPB games could point to bunting being an effective way to score considering the ability of Japanese players. In this situation, the analytical methods will have to be adapted and teams will have to find a way to properly evaluate players with this skillset. Regardless, teams will have to be prepared to find new methods of statistical analysis that fit the Japanese style of play, and league officials will have to be prepared to implement new rules to keep the game appealing to the Japanese market.

Another consideration the NPB will have to be aware of is the potential for a more active posting system. As Japanese players are more thoroughly evaluated with batted ball data and advanced metrics, MLB teams might be more inclined to invest in a posted player, especially considering that the cost of doing so has decreased with the revised posting rules. With more data available on players, teams can better project their success and the risk of spending money on a posting fee is decreased. The consequence of this is that NPB teams will lose their best players, who are often valuable marketing tools, reflecting why the posting system was implemented in the first place. To fight this NPB teams could choose not to share their data with MLB teams in hopes of protecting their best players and assets. They could focus on acquiring or developing players like Nakashima that are statistically valuable to the Japanese game, that likely wouldn't be as valuable to MLB teams. An alternative strategy could embrace the transfer of

their players to the major leagues. A Japanese team could focus on developing players with skillsets that appeal to MLB teams like those with a lot of power and high exit velocities, capable of hitting homeruns and extra-base hits. This value could be marketed to MLB teams with statistical backing, and the NPB team could receive posting fees more frequently, potentially at higher values, as more players are posted. By properly leveraging their data, Japanese players could prove their value and ability with advanced metrics, and likely command higher long-term contracts, consequently increasing the posting fee the NPB teams receive. While they would lose their best players, teams could put their resources towards development, as the SoftBank Hawks have, and create a talent pool of players that can replace those that depart for the major leagues, or even more players with the potential of being posted. These earnings could also be remitted back to the parent company, dependent on the strategy the team chooses. Players would advocate for this, as for many, playing in the U.S. is their ultimate goal. “They are attracted to the higher pay and prestige of the major leagues and eager to be free of the rigid Japanese style discipline and the excessive practice of the Japanese system. As expatriate American pitcher Jeremy Powell, who plays for the Softbank Hawks, puts it, ‘These guys can’t wait to get to the States’” (Whiting, 2008). Prior to the 2014 season, pitcher Masahiro Tanaka posted from the Rakuten Golden Eagles to the New York Yankees for the max fee of \$20,000,000 and agreed to a 7-year deal worth \$155,000,000 (See Figure 6). This is the highest amount of guaranteed money given through the posting system and represents possible future contracts with lower posting fees. While not every Japanese player can command a Tanaka-level contract, they can still expect to earn more than staying in Japan with the MLB’s minimum salary in 2020 nearly four times higher than the NPB’s (Allen, 2020; “Minimum Salary,” 2020).



An argument against a more active posting system is that when popular NPB players move to the MLB, NPB TV viewership declines as more Japanese fans choose to watch their national heroes in morning MLB broadcasts over the NPB ones at night. Robert Whiting said in an article for *Time*, “TV ratings for the Tokyo Giants, in particular, have fallen several percentage points since live MLB casts became a regular morning affair in Japan.” For the Japanese people, it is a sense of pride to have their players competing with the best in baseball’s highest level. Prior to playing in 2018 season opening games at the Tokyo Dome against the Oakland A’s, Yusei Kikuchi of the Seattle Mariners said, “In Japan, baseball culture is huge, and they really respect the major leagues. I was one of those kids that always looked up to major leaguers. I’m really excited for fans and for young players to look at major leaguers and ask themselves, ‘What do I have to do to get to this level?’ I think it will be a great opportunity for coaches, kids and fans just to see major league baseball. Just a great opportunity for them to be there.” (Rivera, 2019). An anonymous Japanese official has differing views on MLB openers in Japan, saying “Every time the MLB holds one of their openers in Japan, sales of our opening week tickets go down.... We see more and more empty seats. It’s not necessary for the big leaguers to come here” (Whiting, 2008). While the fans love watching players like Ichiro Suzuki, Masahiro Tanaka, and Kenta Maeda represent their country, NPB teams have historically viewed the loss of their best players to the MLB as something harmful to the success of their league.

However, more Japanese players in the MLB could have a positive effect on the popularity of the league. Out of the 288 foreign-born players on 2020 MLB opening day rosters, only 9 were from Japan (“Opening Day Rosters,” 2020). A successful Japanese player in the MLB could still be considered somewhat of a rarity, possibly explaining why MLB games are so popular in Japan. If more Japanese players were posting regularly and this became less of an

anomaly, the Japanese fans could be less likely to substitute the MLB for the NPB. If a player is expected to be posted after the season, excitement builds around that player and fans could be more likely to buy tickets and see him play before he departs. More Japanese players playing at the highest level could increase national interest in the sport and be beneficial to the NPB in the long run. Shohei Ohtani of the Los Angeles Angels, posted from the Nippon-Ham Fighters in 2017, views the MLB influence on the Japanese fans as a positive thing, saying “It's a pretty rare opportunity for MLB games to be held in Japan, especially regular-season games -- and especially with the Mariners and Ichiro and Kikuchi playing there, there is a lot of interest. Hopefully for the Japanese people who are not baseball fans yet, it could lead them to become baseball fans” (Rivera, 2018).

The NPB could also see growth comparable to Major League Soccer in the United States. Once a league with relatively little popularity, the MLS has significantly improved its development facilities and the league has expanded rapidly as soccer popularity grows in the United States. The league is expecting to have 30 teams by 2022, up from 24 in 2019 (Young, 2020). United States Men’s National Team coach Craig Berhalter said, “The owners of MLS, they invested a ton of money in youth academies, in facilities, in coaching, and now you’re seeing the fruits of their labor” (Straus, 2020). The MLS is experiencing this growth and success, despite the best U.S.-born players playing in Europe. Nine American-born players have played in the 2020-2021 UEFA Champion’s League with a record seven players playing in the span of one week in December 2020 (Goff, 2020; Karlsen, 2021). As potential soccer fans have seen U.S. players competing at the highest level, they have become more interested in the game and Major League Soccer has simultaneously become a fast-growing league with high potential for revenue growth.

While it can't be assumed that more Japanese players in the MLB will have a similar effect on the NPB, Japanese players at the highest levels could lead to overall growth. Teams could benefit directly from more frequent and increased posting fees, and indirectly from more excitement surrounding the sport, while maintaining a high level of play that fans would still be interested in watching. Regardless of the outcome, NPB teams will have to consider how they want to leverage their data in terms of their relationship with the MLB.

### **Conclusion**

Sooner or later, NPB teams will have to decide what their primary objective is. Do they serve only as a less expensive vehicle for advertising for their parent company? Or is their goal to be a sports franchise capable of competing for championships? Such decisions call into question the financial benefits of investing in sabermetric research. While most teams are now tracking data with TrackMan, many are still learning how to analyze it. "But that doesn't mean that they know what to do with the data, in part because of the difficulty of finding analytical and computer programming talents in Japan who are also well-versed in baseball. Programming hasn't been as widely accepted as a path to front offices as it has in the states, and teams are often staffed with employees of their parent companies in temporary positions." (Lindbergh, 2017b). Even if teams could find proper talent, it is expensive to pay salaries of full-time researchers, especially when most of the clubs aren't currently profitable. The financial benefits of winning more games would have to outweigh the cost of hiring capable analysts. This is also assuming that the parent companies feel they would benefit from their baseball team winning, considering the recent financial woes and unprofitability of the league as a whole. It could be argued that on-field success would in turn increase the value of both the baseball franchise and

the parent company. As with the SoftBank Hawks, they have seen increased attendance due to their success over the past decade. The popularity of the team has grown, providing more exposure to the SoftBank brand. In 2020 the Pacific League, the SoftBank Hawks' league even agreed to a deal to broadcast games in the U.S. with the hopes growing league exposure and interest, which gives the parent companies exposure to a large market outside of Japan (Coskrey, 2020).

The level in which teams invest in sabermetrics depends entirely on the purpose of the teams in the eyes of their owners. Fukuoka has made it clear that they intend to win with the investment in their farm system facilities and player development, as well as their progressiveness in using analytics to gain an advantage. SoftBank appears to view the success of the Hawks as a success for the company. While many teams are beginning to follow their lead, whether it be through beginning to track data or using DeltaGraphs for consulting purposes, they must do so fully with a commitment to make the team as competitive as possible. Otherwise, any investment in sabermetric research without a full commitment to operate as a competitive baseball franchise is not supporting the objective of the team as a marketing tool.

The growth of sabermetrics in Japan marks a turning point in the country's baseball culture, where the top professional teams of Nippon Professional Baseball will face strategic decisions that will significantly alter the aesthetic and financial implications of the league. Whether or not teams will fully embrace advanced analytics, as well as the different methods in which they leverage their research, is yet to be seen. This transitional period will ultimately reveal the parent corporations' perception of their subsidiary baseball teams and the value they bring.

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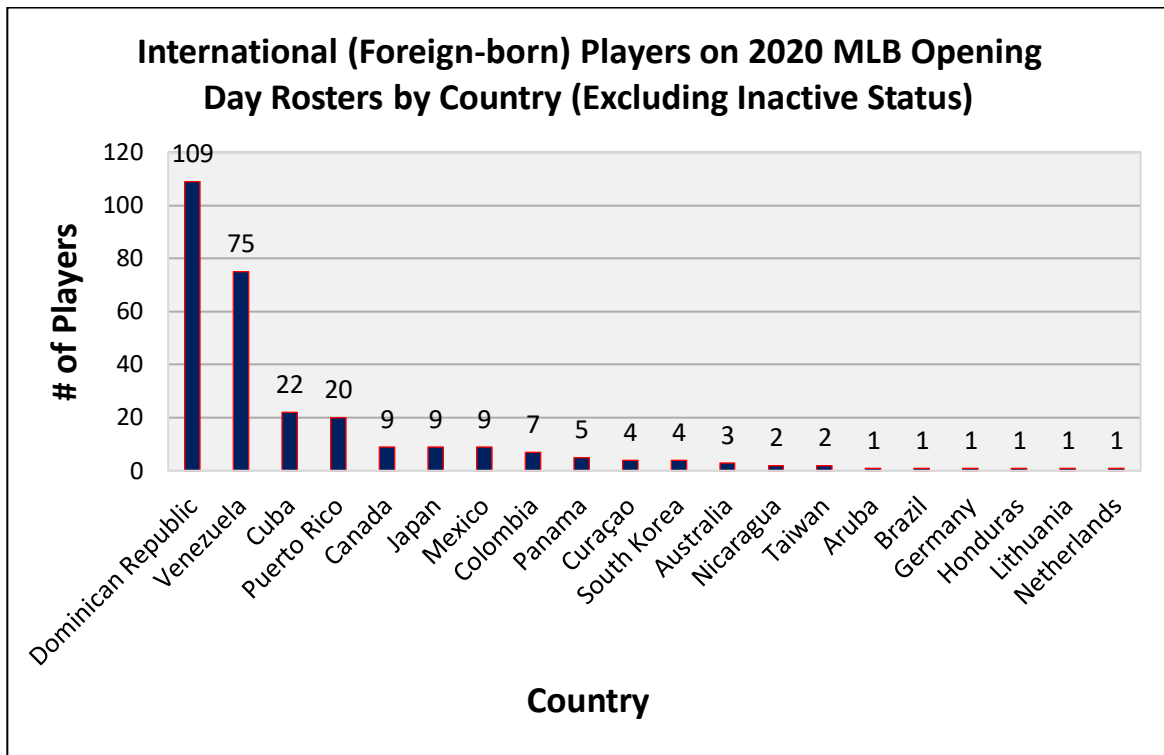
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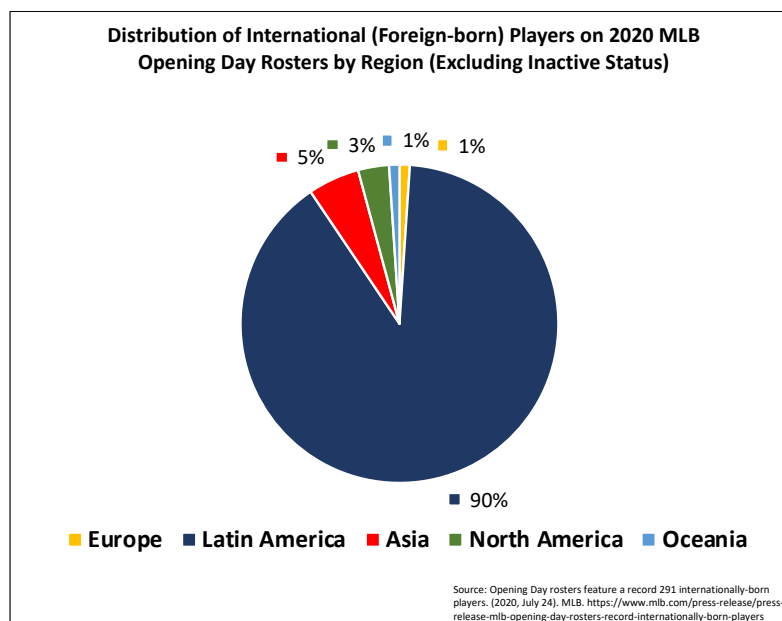
## Appendix

**Figure 1.** MLB International Player Distribution by Country

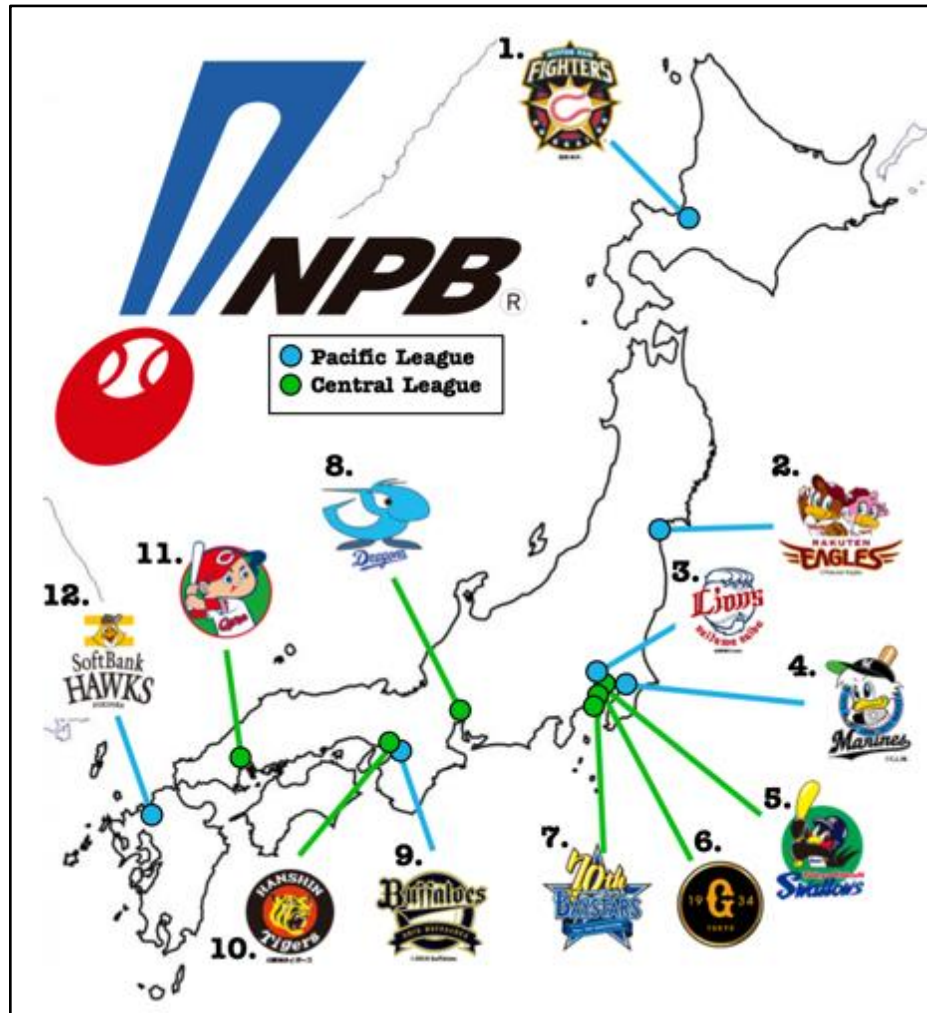


Source: Opening Day rosters feature a record 291 internationally-born players. (2020, July 24). MLB. <https://www.mlb.com/press-release/press-release-mlb-opening-day-rosters-record-internationally-born-players>

**Figure 2.** MLB International Player Distribution by Region



**Figure 3.** Map of Nippon Professional Baseball Teams Across Japan



**Figure 4.** Table of Nippon Professional Baseball Teams

Team	City	League	Year Founded	No. on Map
Chunichi Dragons	Nagoya	Central	1936	8
Hanshin Tigers	Osaka (Nishinomiya)	Central	1935	10
Hiroshima Toyo Carp	Hiroshima	Central	1950	11
Tokyo Yakult Swallows	Tokyo (Shinjuku)	Central	1950	5
Yokohama DeNA BayStars	Yokohama	Central	1949	7
Yomiuri Giants	Tokyo (Bunkyo)	Central	1934	6
Chiba Lotte Marines	Chiba	Pacific	1949	4
Fukuoka SoftBank Hawks	Fukuoka	Pacific	1938	12
Hokkaido Nippon-Ham Fighters	Sapporo	Pacific	1945	1
Orix Buffaloes	Osaka	Pacific	1936	9
Saitama Seibu Lions	Tokorozawa	Pacific	1950	3
Tohoku Rakuten Golden Eagles	Sendai	Pacific	2005	2

**Figure 5.** Table of Japanese Posting System History

Past Successful and Unsuccessful Postings from NPB to MLB						
Posting Date	Player	NPB Team	MLB Team	Transfer Fee	Contract Agreement Date	Notes
<b>Version 1: Blind Bidding System with No Maximum Fee; Team that Submitted Highest Bid Retained Exclusive Negotiation Rights</b>						
2/2/99	Alejandro Quezada	Hiroshima Toyo Carp	Cincinnati Reds	\$400,001	3/2/99	signed a minor league contract
2/2/99	Timo Perez	Hiroshima Toyo Carp	none			re-signed with the Carp on February 3, 1999 for ¥34.5 million
11/9/00	Ichiro Suzuki	Orix BlueWave	Seattle Mariners	\$13,125,000	11/30/00	agreed to a 3-year, \$14 million contract
1/3/02	Kazuhisa Ishii	Tokyo Yakult Swallows	Los Angeles Dodgers	\$11,260,000	2/2/02	agreed to a 4-year, \$12.3 million contract
12/18/02	Akinori Otsuka	Osaka Kintetsu Buffaloes	none			signed with the Dragons on March 20, 2003 for ¥95 million
2/6/03	Ramon Ramirez	Hiroshima Toyo Carp	New York Yankees	\$300,500	3/9/03	signed a minor league contract
11/11/03	Akinori Otsuka	Chunichi Dragons	San Diego Padres	\$300,000	12/10/03	agreed to a two-year, \$1.8 million contract
1/28/05	Norihiro Nakamura	Orix Buffaloes	Los Angeles Dodgers	unknown	2/3/05	signed a minor league contract
11/22/05	Yusaku Iriki	Hokkaido Nippon-Ham Fighters	none			failed to draw any bids and was released by Fighters on December 5, 2005; signed by the New York Mets on January 18, 2006 to a one-year, \$750,000 contract
12/12/05	Shinji Mori	Saitama Seibu Lions	Tampa Bay Devil Rays	\$1,000,000	unknown	agreed to a two year, \$1.3 million contract
11/2/06	Daisuke Matsuzaka	Saitama Seibu Lions	Boston Red Sox	\$51,111,111.11	12/13/06	agreed to a six-year, \$52 million contract
11/6/06	Akinori Iwamura	Tokyo Yakult Swallows	Tampa Bay Devil Rays	\$4,500,000	12/15/06	agreed to a three-year, \$7.7 million contract
11/17/06	Kei Igawa	Hanshin Tigers	New York Yankees	\$26,000,194	12/28/06	agreed to a five-year, \$20 million contract
12/18/08	Koji Mitsui	Saitama Seibu Lions	none			failed to draw any bids from an MLB team, was re-posted the next month
1/8/09	Koji Mitsui	Saitama Seibu Lions	none			again failed to draw any bids, re-signed with the Lions on January 20, 2009 to a one-year contract for ¥57 million
11/2/10	Hisashi Iwakuma	Tohoku Rakuten Golden Eagles	Oakland Athletics	\$19,100,000		turned down a four-year, \$15,250,000 contract to remain with Rakuten
11/15/10	Tsuyoshi Nishioka	Chiba Lotte Marines	Minnesota Twins	\$5,329,000	12/17/10	agreed to a three-year, \$9.25 million contract
11/23/11	Hiroki Sanada	Yokohama DeNA BayStars	none			Failed to draw any bids from an MLB team, later released by the BayStars
11/23/11	Hirofumi Nakajima	Saitama Seibu Lions	New York Yankees	\$2,000,000		unable to reach agreement on a contract and returned to Seibu
12/12/11	Norichika Aoki	Tokyo Yakult Swallows	Milwaukee Brewers	\$2,500,000	1/17/12	agreed to a two-year, \$2.5 million contract
12/8/11	Yu Darvish	Hokkaido Nippon Ham Fighters	Texas Rangers	\$51,700,000	1/18/12	agreed to a six-year, \$60 million contract
<b>Version 2: Fee Determined by NPB Team with a Maximum of \$20,000,000 and Players' Ability to Negotiate with Any MLB Team</b>						
12/26/13	Masahiro Tanaka	Rakuten Golden Eagles	New York Yankees	\$20,000,000	1/22/14	agreed to a seven-year, \$155 million contract
11/2/15	Tony Barnette	Tokyo Yakult Swallows	none			failed to draw any bids from an MLB team; later released by the Swallows; signed by the Texas Rangers on December 15, 2015 to a two-year, \$3.5 million contract
12/8/15	Kenta Maeda	Hiroshima Carp	Los Angeles Dodgers	\$20,000,000	1/7/16	agreed to an eight-year contract worth a minimum of \$25 million and a maximum of \$106.2 million
12/1/17	Shohei Ohtani	Hokkaido Nippon-Ham Fighters	Los Angeles Angels	\$20,000,000	12/8/17	agreed to a bonus of \$2.32 million and the major league minimum salary (\$545,000)
12/11/17	Kazuhisa Makita	Saitama Seibu Lions	San Diego Padres	\$500,000	1/6/18	agreed to a two-year, \$3.8 million contract
<b>Version 3: Most Recent Agreement Implemented with Fee as a Percentage of Signed Contract</b>						
12/3/18	Yusei Kikuchi	Saitama Seibu Lions	Seattle Mariners	\$10,275,000	12/31/18	agreed to a four-year, \$56 million contract with options for up to three additional seasons
11/19/19	Yoshitomo Tsutsugo	Yokohama DeNA BayStars	Tampa Bay Rays	\$2,400,000	12/13/19	agreed to a four-year, \$12 million contract
12/3/19	Ryosuke Kikuchi	Hiroshima Toyo Carp	none			failed to secure a contract with any MLB team, signed a 4-year contract extension with the Carp on December 27, 2019 for ¥1.2 billion
12/3/19	Shun Yamaguchi	Yomiuri Giants	Toronto Blue Jays	\$1,200,000	12/17/19	agreed to a two-year, \$6 million contract
11/26/20	Kohei Aihara	Nippon Ham Fighters	Texas Rangers	\$1,240,000	12/25/20	agreed to a two-year, \$6.2 million contract
12/7/20	Haruki Nishikawa	Nippon Ham Fighters	none			failed to secure a contract with any MLB team
12/7/20	Tomoyuki Sugano	Yomiuri Giants	none			failed to secure a contract with any MLB team, re-signed with the Giants

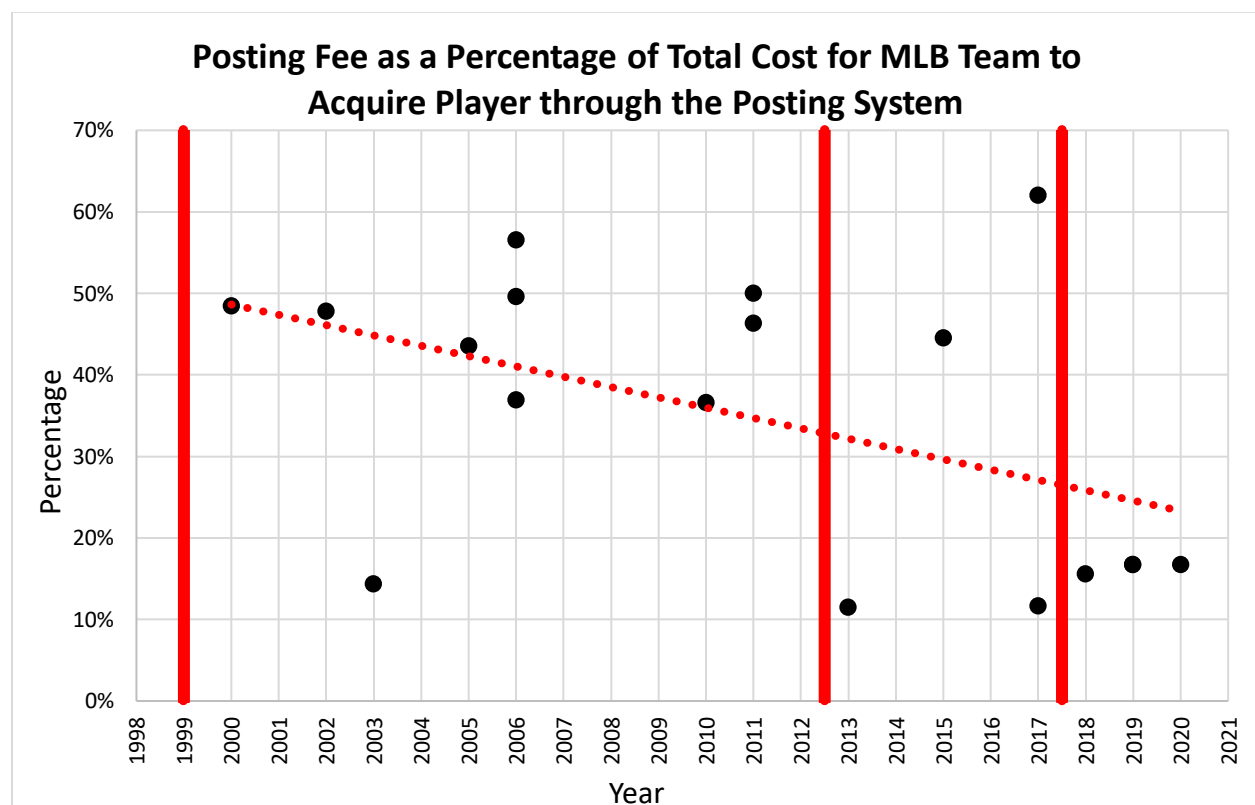
Source: Posting System. (2021, January 8). Baseball-Reference. [https://www.baseball-reference.com/bulpen/Posting\\_System](https://www.baseball-reference.com/bulpen/Posting_System)

**Figure 6.** Table of Successful Japanese Postings to MLB

Successful Postings of Players that Received Major League Contracts							
Player	Year	MLB Team	Posting Fee	Length of Contract in Years	Size of Contract	Total Cost to Team	Fee/Total Cost
<b>Version 1: Blind Bidding System with No Maximum Fee; Team that Submitted Highest Bid Retained Exclusive Negotiation Rights</b>							
Ichiro Suzuki	2000	Seattle Mariners	\$ 13,125,000	3	\$ 14,000,000	\$ 27,125,000	48.39%
Kazuhisa Ishii	2002	Los Angeles Dodgers	\$ 11,260,000	4	\$ 12,300,000	\$ 23,560,000	47.79%
Akinori Otsuka	2003	San Diego Padres	\$ 300,000	2	\$ 1,800,000	\$ 2,100,000	14.29%
Shinji Mori	2005	Tampa Bay Devil Rays	\$ 1,000,000	2	\$ 1,300,000	\$ 2,300,000	43.48%
Daisuke Matsuzaka	2006	Boston Red Sox	\$ 51,111,111	6	\$ 52,000,000	\$ 103,111,111	49.57%
Akinori Iwamura	2006	Tampa Bay Devil Rays	\$ 4,500,000	3	\$ 7,700,000	\$ 12,200,000	36.89%
Kei Igawa	2006	New York Yankees	\$ 26,000,194	5	\$ 20,000,000	\$ 46,000,194	56.52%
Tsuyoshi Nishioka	2010	Minnesota Twins	\$ 5,329,000	3	\$ 9,250,000	\$ 14,579,000	36.55%
Norichika Aoki	2011	Milwaukee Brewers	\$ 2,500,000	2	\$ 2,500,000	\$ 5,000,000	50.00%
Yu Darvish	2011	Texas Rangers	\$ 51,700,000	6	\$ 60,000,000	\$ 111,700,000	46.28%
<b>Version 2: Fee Determined by NPB Team with a Maximum of \$20,000,000 and Players' Ability to Negotiate with Any MLB Team</b>							
Masahiro Tanaka	2013	New York Yankees	\$ 20,000,000	7	\$ 155,000,000	\$ 175,000,000	11.43%
Kenta Maeda	2015	Los Angeles Dodgers	\$ 20,000,000	8	\$ 25,000,000	\$ 45,000,000	44.44%
Shohei Ohtani*	2017	Los Angeles Angels	\$ 20,000,000	5	\$ 12,269,259	\$ 32,269,259	61.98%
Kazuhisa Makita	2017	San Diego Padres	\$ 500,000	2	\$ 3,800,000	\$ 4,300,000	11.63%
<b>Version 3: Most Recent Agreement Implemented with Fee as a Percentage of Signed Contract</b>							
Yusei Kikuchi	2018	Seattle Mariners	\$ 10,275,000	4	\$ 56,000,000	\$ 66,275,000	15.50%
Yoshitomo Tsutsugo	2019	Tampa Bay Rays	\$ 2,400,000	4	\$ 12,000,000	\$ 14,400,000	16.67%
Shun Yamaguchi	2019	Toronto Blue Jays	\$ 1,200,000	2	\$ 6,000,000	\$ 7,200,000	16.67%
Kohei Aihara	2020	Texas Rangers	\$ 1,240,000	2	\$ 6,200,000	\$ 7,440,000	16.67%

\*At the time of his posting, Shohei Ohtani was under 25 years old and therefore subject to the MLB CBA's international signing rules, which limited him to the rookie salary scale and a capped signing bonus. After three years, in his first year of arbitration, he agreed to a 2-year, \$8.5 million contract. So, the size of his contract in this chart was calculated using the sum of his guaranteed earnings, including his signing bonus, over the 5-year duration of the contracts (2017 – 2021).

**Figure 7.** Scatterplot of Decreasing Fees as a Percentage of the Total Cost for an MLB Team to Acquire a Player



**Figure 8.** Table of NPB Parent Companies

Team	League	Parent Company/Owner	Primary Industry/Type of Business
Chunichi Dragons	Central	Chunichi Shimbun Co., Ltd.	Newspaper
Hanshin Tigers	Central	Hanshin Electric Railway Co., Ltd.	Rail Transit
Hiroshima Toyo Carp	Central	Matsuda Family/Mazda Motor Corporation	Automotive Manufacturing
Tokyo Yakult Swallows	Central	Yakult Honsha Co., Ltd.	Food, Beverage, and Pharmaceuticals (Yogurt/Probiotic Drinks)
Yokohama DeNA BayStars	Central	DeNA Co., Ltd.	Mobile Provider, E-commerce
Yomiuri Giants	Central	Yomiuri Shimbun	Newspaper
Chiba Lotte Marines	Pacific	Lotte Corporation	Food, Beverage, and Confections
Fukuoka SoftBank Hawks	Pacific	SoftBank Group Corp.	Telecommunications, Technology, Financial Services
Hokkaido Nippon-Ham Fighters	Pacific	NH Foods Ltd.	Food Processing, Meat Packing
Orix Buffalos	Pacific	ORIX Corporation	Financial Services
Saitama Seibu Lions	Pacific	Seibu Railway Company, Ltd.	Rail Transit
Tohoku Rakuten Golden Eagles	Pacific	Rakuten Group, Inc.	E-commerce

**Figure 9.** Table of NPB Teams with TrackMan Installed in Stadium

Team	League	Stadium	Has TrackMan?	First Instance of TrackMan Installation (Month-Year)
Chunichi Dragons	Central	Valetin Dome Nagoya	Yes	March-18
Hanshin Tigers	Central	Hanshin Koshien Stadium	No Evidence	N/A
Hiroshima Toyo Carp	Central	MAZDA Zoom-Zoom Stadium Hiroshima	No Evidence	N/A
Tokyo Yakult Swallows	Central	Meiji Jingu Stadium	Yes	March-18
Yokohama DeNA BayStars	Central	Yokohama Stadium	Yes	October-19
Yomiuri Giants	Central	Tokyo Dome	Yes	July-17
Chiba Lotte Marines	Pacific	ZOZO Marine Stadium	No Evidence	N/A
Fukuoka SoftBank Hawks	Pacific	Fukuoka PayPay Dome	Yes	April-17
Hokkaido Nippon-Ham Fighters	Pacific	Sapporo Dome	Yes	October-16
Orix Buffalos	Pacific	Kyocera Dome Osaka	Yes	August-16
Saitama Seibu Lions	Pacific	MetLife Dome	Yes	December-16
Tohoku Rakuten Golden Eagles	Pacific	Rakuten Seimei Park Miyagi	Yes	April-17



**Figure 9A1.** Photo Evidence of TrackMan in Valentin Dome Nagoya (Earliest Found Occurrence) – by Matsuura Yuichi (March 2018)



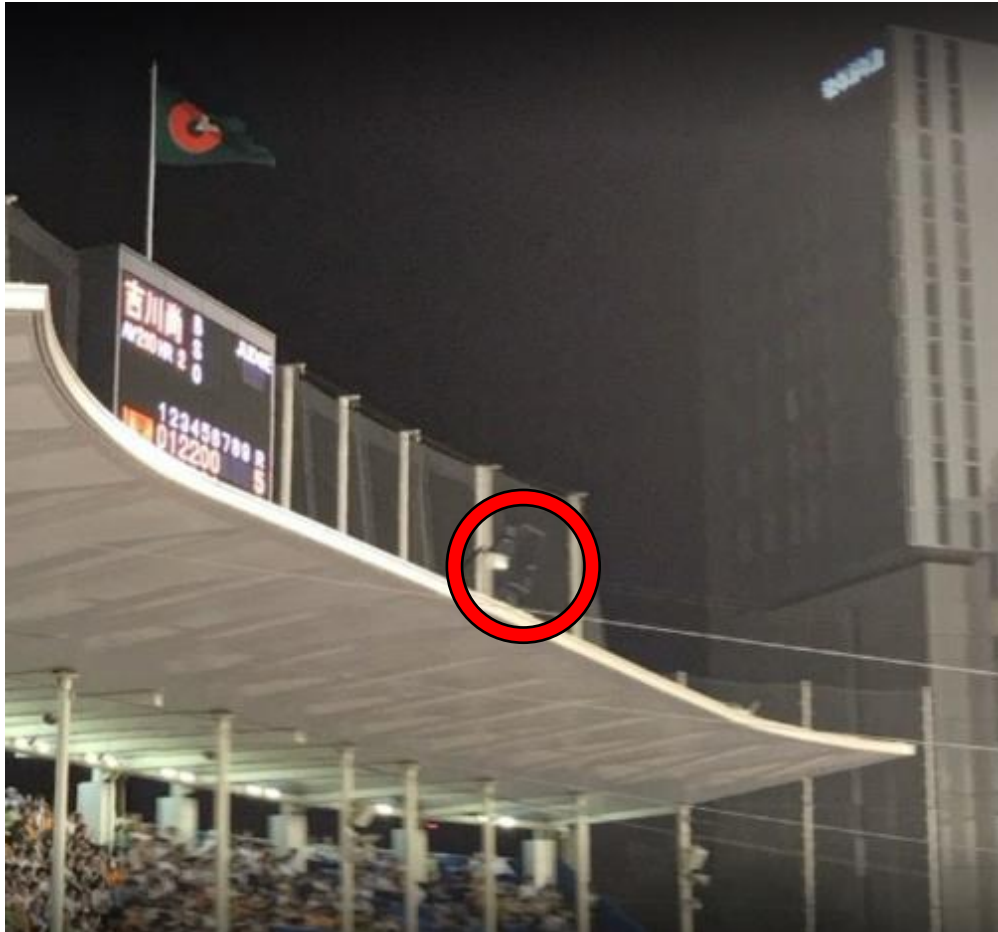
**Figure 9A2.** TrackMan in Valentin Dome Nagoya Confirmation – by よしくん (April 2019)



**Figure 9B1.** Photo Evidence of TrackMan in Meiji Jingu Stadium (Earliest Found Occurrence) –  
by Y K (March 2018)



**Figure 9B2.** TrackMan in Meiji Jingu Stadium Confirmation – by Russell Mahoney (July 2018)

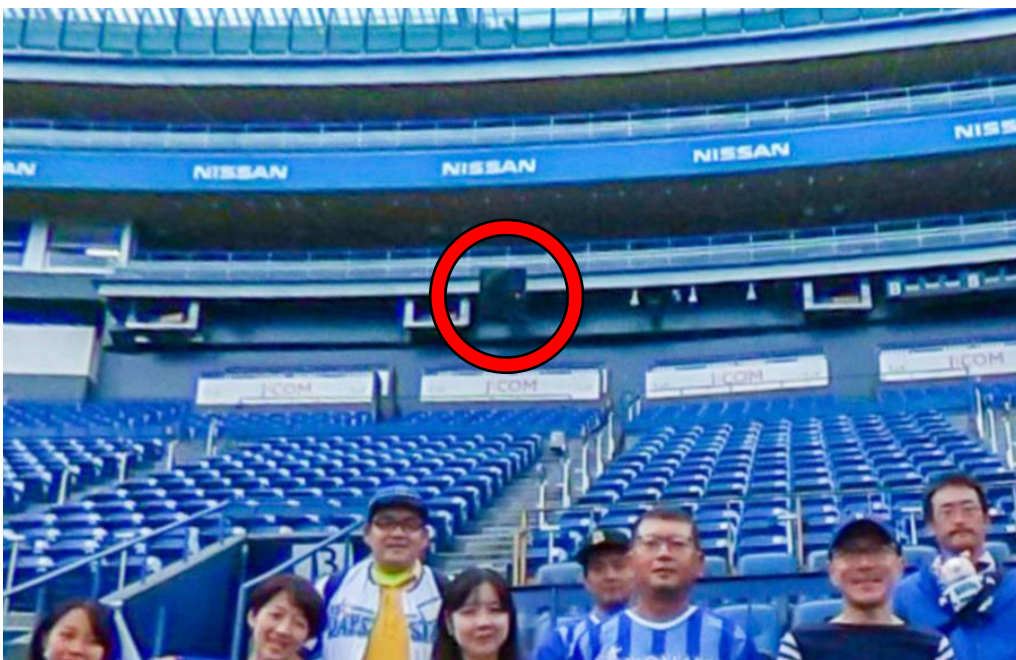




**Figure 9C1.** Photo Evidence of TrackMan in Yokohama Stadium (Earliest Found Occurrence) –  
by Shingeru Sanada (July 2018)



**Figure 9C2.** TrackMan in Yokohama Stadium Confirmation – by ブリッジ BRIDDI Co. Ltd.  
(September 2019)



**Figure 9D1.** Photo Evidence of TrackMan in Tokyo Dome (Earliest Found Occurrence) – by Halee Pagel (July 2017)

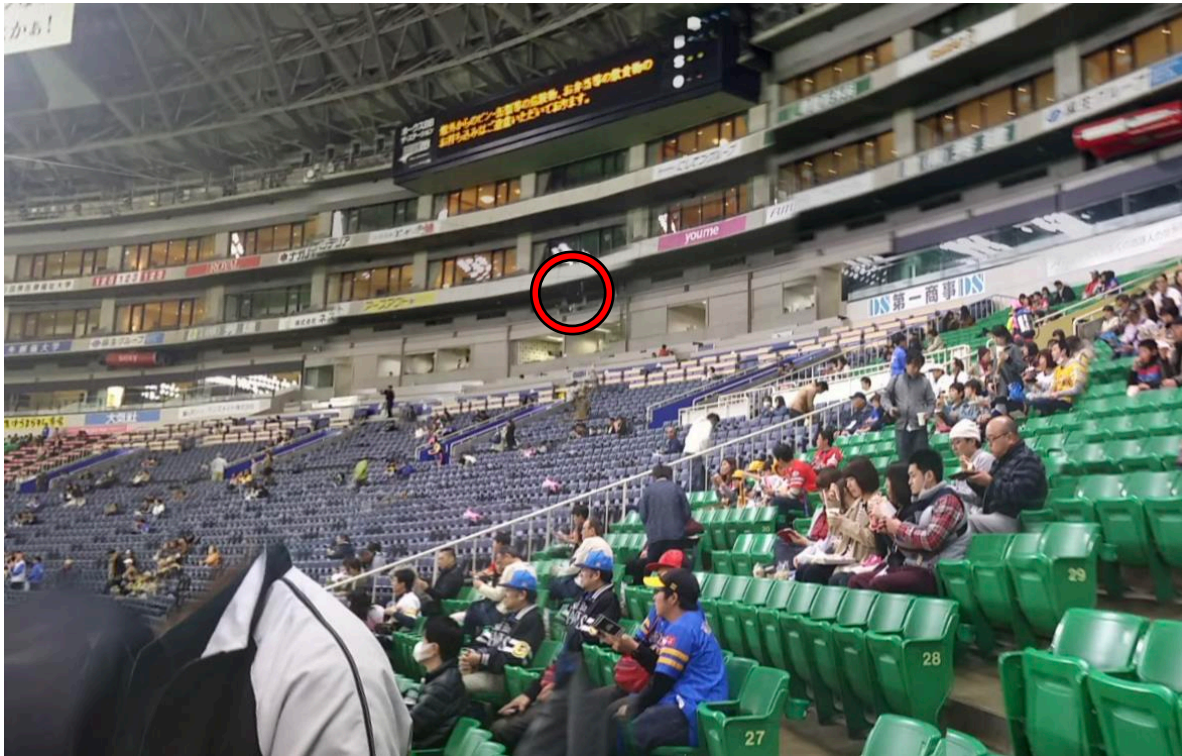


**Figure 9D2.** TrackMan in Tokyo Dome Confirmation – by Zack Hample (March 2019)





**Figure 9E.** Photo Evidence of TrackMan in Fukuoka PayPay Dome (Only Found Occurrence) –  
by 石江千成 (April 2017)



**Figure 9F.** Photo Evidence of TrackMan in Sapporo Dome (Only Found Occurrence) – by  
Kousakushima (October 2016)



**Figure 9G.** Photo Evidence of TrackMan in Kyocera Dome Osaka (Only Found Occurrence) –  
by Na Hi (August 2016)





**Figure 9H1.** Photo Evidence of TrackMan in MetLife Dome (Earliest Found Occurrence) – by KAMING CO., LTD. (December 2016)



**Figure 9H2.** TrackMan in MetLife Dome Confirmation – by KAMING CO., LTD. (April 2019)





**Figure 9I.** Photo Evidence of TrackMan in Rakuten Seimei Park Miyagi (Only Found Occurrence) – by Trip Inc. (April 2017)



**Figure 10.** Photo Evidence of TrackMan in Tama Home Stadium (Fukuoka SoftBank Hawks Farm Base) – by 富田茂 (September 2016)



**Figure 11.** [YouTube Video of Takuya Nakashima 12-pitch At-Bat \(Link\)](#)

